

1           What is claimed is:

2           1.    A method for monitoring performance of an advanced  
3 process control system for at least one static process  
4 output, the method comprising the steps of:

5           receiving process performance data for the at least one  
6 static process output;

7           comparing the process performance data to at least one  
8 of a predicted value for the process performance and a  
9 target value for the process performance;

10          calculating at least one index that reflects comparison  
11 of the process performance data to the at least one of the  
12 predicted value for the process performance and the target  
13 value for the process performance; and

14          indicating the results of the calculation based on the  
15 at least one index, wherein the results indicate a status of  
16 the advanced process control system.

17          2.    The method of claim 1, wherein the step of  
18 indicating the results of the calculation comprises at least  
19 one of sending an indication to a controller that the at  
20 least one index is beyond an acceptable point, halting  
21 processing of the at least one process output if the at  
22 least one index is beyond an acceptable point, and storing  
23 the at least one index as an indication of the processing  
24 performance of the at least one process output.

1           3.    The method of claim 2, wherein sending an  
2    indication to a controller further comprises sending at  
3    least one of a page, an electronic mail message, and a  
4    message to a wireless personal data assistant.

5           4.    The method of claim 1, wherein performing the step  
6    of indicating the results further comprises displaying the  
7    at least one index in a visual output to allow a controller  
8    to assess the process performance of the at least one  
9    process output.

10          5.    A method for monitoring performance of an advance  
11    process control system for at least one process output, the  
12    method comprising the steps of:

13           receiving process performance data for the at least one  
14    process output;

15           calculating at least one of a model health index,  
16    wherein the model health index indicates an estimate of an  
17    ability of a model to predict the behavior of the at least  
18    one process output as compared to an expected output, and a  
19    process health index, wherein the process health index  
20    indicates an estimated probability of violation by the at  
21    least one process output of predefined specification limits;  
22    and

23           indicating the results of the calculation based on the  
24    at least one of the model health index and the process  
25    health index.

1           6.    The method of claim 5, wherein the step of  
2   calculating the model health index further comprises the  
3   steps of:

4           calculating a variance of a prediction error for a  
5   processing performance of the at least one process output;  
6   and

7           calculating a ratio of an estimate of a standard  
8   deviation of the prediction error to an expected estimate of  
9   the prediction error, wherein the standard deviation of the  
10   prediction error is derived from the variance of the  
11   prediction error.

12          7.    The method of claim 6, wherein the variance of the  
13   prediction error indicates a bias between an actual output  
14   of the at least process output and the expected output.

15          8.    The method of claim 6, wherein the variance of the  
16   prediction error is based on an exponentially weighted  
17   moving average.

18          9.    The method of claim 6, wherein the estimate of the  
19   standard deviation of the prediction error is based on an  
20   exponentially weighted moving average.

21          10.   The method of claim 5, wherein the step of  
22   calculating the process health index further comprises the  
23   steps of:

1       calculating a probability for violating specification  
2 limits of a processing performance of the at least one  
3 process output; and

4       calculating a ratio of the probability for violating  
5 the specification limits to a specified probability limit.

6       11. The method of claim 6, wherein the step of  
7 calculating the process health index further comprises the  
8 step of calculating a variance of a target deviation for the  
9 processing performance of the at least one process output,  
10 wherein the variance of the target deviation indicates a  
11 bias between an actual output of the at least one process  
12 output and a target output.

13       12. The method of claim 11, wherein the variance of  
14 the target deviation is based on an exponentially weighted  
15 moving average.

16       13. The method of claim 5, further comprising the step  
17 of performing a notification function, wherein the  
18 notification function comprises sending an indication to a  
19 controller that the at least one of the model health index  
20 and the process health index is beyond an acceptable point.

21       14. The method of claim 13, wherein sending an  
22 indication to a controller further comprises sending at  
23 least one of a page, an electronic mail message, and a  
24 message to a wireless personal data assistant.

1           15. The method of claim 5, further comprising the step  
2 of performing a notification function, wherein the  
3 notification function comprises halting processing of the at  
4 least one process output if the at least one of the model  
5 health index and the process health index is beyond an  
6 acceptable point.

7           16. The method of claim 5, further comprising the step  
8 of performing a notification function, wherein the  
9 notification function further comprises displaying the at  
10 least one of the model health index and the process health  
11 index in a visual display to allow a controller to assess  
12 the process performance of the at least one process output.

13           17. The method of claim 5, further comprising the step  
14 of performing a notification function, wherein the  
15 notification function comprises storing the at least one of  
16 the model health index and the process health index, such  
17 that the at least one of the model health index and the  
18 process health index serves as an indication of the  
19 processing performance of the at least one process output.

20           18. The method of claim 17, wherein the notification  
21 function further comprises displaying the stored at least  
22 one of the model health index and the process health index  
23 in a visual display to allow a controller to assess the  
24 process performance of the at least one process output.

1        19. A method for monitoring performance of an advanced  
2 process control system for at least one process output, the  
3 method comprising the steps of:

4        calculating at least one of a variance of a prediction  
5 error for a processing performance of the at least one  
6 process output and a probability for violating specification  
7 limits of the processing performance of the at least one  
8 process output, wherein the at least one of the variance and  
9 the probability are based on an exponentially weighted  
10 moving average;

11       if the variance of the prediction error is calculated,  
12 calculating a model health index, wherein the model health  
13 index is a ratio of an exponentially weighted moving  
14 average-based estimate of a standard deviation of the  
15 prediction error to an expected estimate of the prediction  
16 error, and wherein the exponentially weighted moving  
17 average-based estimate of the standard deviation of the  
18 prediction error is derived from the variance of the  
19 prediction error;

20       if the probability for violating specification limits  
21 is calculated, calculating a process health index, wherein  
22 the process health index is a ratio of the probability for  
23 violating the specification limits to a specified  
24 probability limit; and

1        indicating the results of the calculation based on at  
2        least one of the model health index and the process health  
3        index.

4        20. The method of claim 19, further comprising the  
5        step of performing a notification function, wherein the  
6        notification function comprises sending an indication to a  
7        controller that the at least one of the model health index  
8        and the process health index is beyond an acceptable point.

9        21. The method of claim 20, wherein sending an  
10       indication to a controller further comprises sending at  
11       least one of a page, an electronic mail message, and a  
12       message to a wireless personal data assistant.

13       22. The method of claim 19, further comprising the  
14       step of performing a notification function, wherein the  
15       notification function comprises halting processing of the at  
16       least one process output if the at least one of the model  
17       health index and the process health index is beyond an  
18       acceptable point.

19       23. The method of claim 19, further comprising the  
20       step of performing a notification function, wherein the  
21       notification function further comprises displaying the at  
22       least one of the model health index and the process health  
23       index in a visual display to allow a controller to assess  
24       the process performance of the at least one process output.

1           24. The method of claim 19, further comprising the  
2 step of performing a notification function, wherein the  
3 notification function comprises storing the at least one of  
4 the model health index and the process health index, such  
5 that the at least one of the model health index and the  
6 process health index serves as an indication of the  
7 processing performance of the at least one process output.

8           25. The method of claim 24, wherein the notification  
9 function further comprises displaying the at least one of  
10 the model health index and the process health index in a  
11 visual display to allow a controller to assess the process  
12 performance of the at least one process output.

13           26. A method for monitoring performance of an advanced  
14 process control system for at least one process output, the  
15 method comprising the steps of:

16           receiving process performance data for the at least one  
17 process output;

18           calculating at least one of a current model health  
19 index, wherein the current model health index indicates an  
20 estimate of an ability of a model to predict the behavior of  
21 a current one of the at least one process output as compared  
22 to an expected output, and a current process health index,  
23 wherein the current process health index indicates an  
24 estimated probability of violation by a current one of the



1 at least one process output of predefined specification  
2 limits;

3 if the current model health index is calculated,  
4 calculating a subsequent model health index, wherein the  
5 subsequent model health index indicates an estimate of an  
6 ability of a model to predict the behavior of a subsequent  
7 one of the at least one process output as compared to an  
8 expected output;

9 if the subsequent model health index is calculated,  
10 storing the current model health index and the subsequent  
11 model health index, such that comparing the current model  
12 health index and the subsequent model health index give an  
13 indication of a processing performance of the at least one  
14 process output;

15 if the current process health index is calculated,  
16 calculating a subsequent process health index, wherein the  
17 subsequent process health index indicates an estimated  
18 probability of violation by a subsequent one of the at least  
19 one process output of predefined specification limits; and

20 if the subsequent process health index is calculated,  
21 storing the current process health index and the subsequent  
22 process health index, such that comparing the current  
23 process health index and the current process health index  
24 gives an indication of the processing performance of the at  
25 least one process output.

1           27. A method for monitoring performance of an advanced  
2 process control system for at least one process output, the  
3 method comprising the steps of:

4           calculating at least one of a current variance of a  
5 prediction error for a processing performance of the at  
6 least one process output and a current probability for  
7 violating specification limits of the processing performance  
8 of the at least one process output, wherein the at least one  
9 of the current variance and the current probability are  
10 based on an exponentially weighted moving average;

11          if the current variance of the prediction error is  
12 calculated, calculating a current model health index,  
13 wherein the current model health index is a ratio of a  
14 current exponentially weighted moving average-based estimate  
15 of a standard deviation of the prediction error to an  
16 expected estimate of the prediction error, and wherein the  
17 current exponentially weighted moving average-based estimate  
18 of the standard deviation of the prediction error is derived  
19 from the current variance of the prediction error;

20          if the current model health index is calculated,  
21 calculating a subsequent model health index, wherein the  
22 subsequent model health index is calculated in a  
23 substantially similar manner to the current model health  
24 index;

1       if the subsequent model health index is calculated,  
2       storing the current model health index and the subsequent  
3       model health index, such that comparing the current model  
4       health index and the subsequent model health index gives an  
5       indication of the processing performance of the at least one  
6       process output;

7       if the current probability for violating specification  
8       limits is calculated, calculating a current process health  
9       index, wherein the current process health index is a ratio  
10      of the probability for violating the specification limits to  
11      a probability limit;

12      if the current process health index is calculated,  
13      calculating a subsequent process health index, wherein the  
14      subsequent process health index is calculated in a  
15      substantially similar manner to the current process health  
16      index; and

17      if the subsequent process health index is calculated,  
18      storing the current process health index and the subsequent  
19      process health index, such that comparing the current  
20      process health index and the subsequent process health index  
21      gives an indication of the processing performance of the at  
22      least one process output.

23      28. A method for monitoring performance of an advanced  
24      process control system for a plurality of process outputs,  
25      the method comprising the steps of:

1       calculating at least one of a first model health index  
2 of a process performance of a first one of the plurality of  
3 process outputs and a first process health index of the  
4 process performance of the first one of the plurality of  
5 process outputs;

6       calculating at least one of a second model health index  
7 of the process performance of a second one of the plurality  
8 of process outputs and a second process health index of the  
9 process performance of the second one of the plurality of  
10 process outputs;

11       if the first model health index and the second model  
12 health index are calculated, calculating an aggregate model  
13 health index of the process performance of the plurality of  
14 process outputs; and

15       if the first process health index and the second  
16 process health index are calculated, calculating an  
17 aggregate process health index of the process performance of  
18 the plurality of process outputs.

19       29. The method of claim 28, wherein the aggregate  
20 model health index is calculated using a geometric mean of  
21 the first model health index and the second model health  
22 index and the aggregate process health index is calculated  
23 using a geometric mean of the first process health index and  
24 the second process health index.

25       30. The method of claim 28, further comprising:

1       calculating at least one of an nth, where n is a number  
2       greater than three, model health index of a process  
3       performance of a nth one of the plurality of process outputs  
4       and a nth process health index of the process performance of  
5       the nth one of the plurality of process outputs;

6       if the first model health index, the second model  
7       health index are calculated, and the nth model health index  
8       are calculated, calculating the aggregate model health index  
9       of the process performance of the plurality of process  
10      outputs; and

11      if the first process health index, the second process  
12      health index, and the nth process health index are  
13      calculated, calculating the aggregate process health index  
14      of the process performance of the plurality of process  
15      outputs.

16      31. The method of claim 30, wherein the aggregate  
17      model health index is calculated using a geometric mean of  
18      the first model health index, the second model health index,  
19      and the nth model health index and the aggregate process  
20      health index is calculated using a geometric mean of the  
21      first process health index, the second process health index,  
22      and the nth process health index.

23      32. A method for monitoring performance of an advanced  
24      process control system for at least one process output, the  
25      method comprising the steps of:

1       estimating a process deviation, wherein the process  
2 deviation indicates deviation of a process performance from  
3 at least one of a target process performance and a model of  
4 the process performance;

5       characterizing a current estimate of the process  
6 performance using at least one of a first index that  
7 represents the deviation of the process performance from the  
8 target process performance and a second index that  
9 represents the deviation of the model performance from a  
10 specified model performance; and

11       performing a notification function based on the value  
12 of at least one of the first index and the second index.

13       33. A system for monitoring performance of an advanced  
14 process control system for at least one process output,  
15 comprising:

16       a first memory that stores at least one of a predicted  
17 value for process performance of the at least one process  
18 output and a target value for process performance of the at  
19 least one process output;

20       a second memory that stores process performance data of  
21 the at least one process output;

22       a third memory that stores at least one of a model  
23 health algorithm and a process health algorithm, wherein the  
24 model health algorithm is used to calculate a model health

1 index of the process performance and the process health  
2 algorithm is used to calculate a process health index of the  
3 process performance; and

4 a processor, operably connected to the first memory,  
5 the second memory and the third memory, that calculates at  
6 least one of the model health index using the model health  
7 algorithm and the process health index using the process  
8 health algorithm, wherein the model health index is  
9 calculated based on a comparison of the predicted value and  
10 the process performance data of the at least one process  
11 output, and wherein the process health index is calculated  
12 based on a comparison of the target value and the process  
13 performance data of the at least one process output.

14 34. The system of claim 33, further comprising a user  
15 input interface that receives the at least one of the  
16 predicted value for process performance of the at least one  
17 process output and the target value for the process  
18 performance of the at least one process output and stores  
19 the at least one of the predicted value and the target value  
20 in the first memory.

21 35. The system of claim 33, wherein the processor is  
22 capable of halting processing of the at least one process  
23 output if the at least one of the model health index and the  
24 process health index is beyond an acceptable point.

1           36. The system of claim 33, further comprising a  
2   communications interface, wherein the processor is capable  
3   of sending a notification message to a controller if the at  
4   least one of the model health index and the process health  
5   index is beyond an acceptable point.

6           37. The system of claim 36, wherein the communications  
7   interface is at least one of a radio transmitter and a  
8   communications port.

9           38. The system of claim 36, wherein the notification  
10   message comprises at least one of a page, an electronic mail  
11   message, and a message to a wireless personal data  
12   assistant.

13          39. The system of claim 33, further comprising a  
14   fourth memory that stores the at least one of the model  
15   health index and the process health index, such that the at  
16   least one of the model health index and the process health  
17   index serves as an indication of the processing performance  
18   of the at least one process output.

19          40. The system of claim 33, further comprising a  
20   display that displays the at least one of the model health  
21   index and the process health index as a visual display, such  
22   that the at least one of the model health index and the  
23   process health index serves as an indication of the  
24   processing performance of the at least one process output.



1        41. A system for monitoring performance of an advanced  
2 process control system for at least one process output,  
3 comprising:

4        first storage means for storing at least one of a  
5 predicted value for process performance of the at least one  
6 process output and a target value for process performance of  
7 the at least one process output;

8        second storage means for storing process performance  
9 data of the at least one process output;

10       third storage means for storing at least one of a model  
11 health algorithm and a process health algorithm, wherein the  
12 model health algorithm is used to calculate a model health  
13 index of the process performance and the process health  
14 algorithm is used to calculate a process health index of the  
15 process performance; and

16       processing means, operably connected to the first  
17 storage means, the second storage means and the third  
18 storage means, that calculates at least one of the model  
19 health index using the model health algorithm and the  
20 process health index using the process health algorithm,  
21 wherein the model health index is calculated based on a  
22 comparison of the predicted value and the process  
23 performance data of the at least one process output, and  
24 wherein the process health index is calculated based on a

1 comparison of the target value and the process performance  
2 data of the at least one process output.

3 42. The system of claim 41, further comprising user  
4 input means for receiving the at least one of the predicted  
5 value for process performance of the at least one process  
6 output and the target value for the process performance of  
7 the at least one process output and storing the at least one  
8 of the predicted value and the target value in the first  
9 storage means.

10 43. The system of claim 41, further comprising control  
11 interface means between the processor and the at least one  
12 process output for enabling the processing means to halt  
13 processing of the at least one process output if the at  
14 least one of the model health index and the process health  
15 index is beyond an acceptable point.

16 44. The system of claim 41, further comprising  
17 communications interface means for enabling the processing  
18 means to send a notification message to a controller if the  
19 at least one of the model health index and the process  
20 health index is beyond an acceptable point.

21 45. The system of claim 44, wherein the notification  
22 message comprises at least one of a page, an electronic mail  
23 message, and a message to a wireless personal data  
24 assistant.

1           46. The system of claim 41, further comprising fourth  
2 storage means for storing the at least one of the model  
3 health index and the process health index, such that the at  
4 least one of the model health index and the process health  
5 index serves as an indication of the processing performance  
6 of the at least one process output.

7           47. The system of claim 41, further comprising display  
8 means for displaying the at least one of the model health  
9 index and the process health index as a visual display, such  
10 that the at least one of the model health index and the  
11 process health index serves as an indication of the  
12 processing performance of the at least one process output.

13           48. A system for monitoring performance of an advanced  
14 process control system for at least one process output,  
15 comprising:

16           means for receiving process performance data for the at  
17 least one process output;

18           means for comparing the process performance data to at  
19 least one of a predicted value for the process performance  
20 and a target value for the process performance;

21           means for calculating at least one parameter that  
22 reflects comparison of the process performance data to the  
23 at least one of the predicted value for the process  
24 performance and the target value for the process  
25 performance; and

1 means for indicating the results of the calculation  
2 based on the at least one parameter.

3 49. The system of claim 48, wherein indicating the  
4 results of the calculation comprises at least one of sending  
5 indication to a controller that the at least one parameter  
6 is beyond an acceptable point, halting processing of the at  
7 least one process output if the at least one parameter is  
8 beyond an acceptable point, and storing the at least one  
9 parameter as an indication of the processing performance of  
10 the at least one process output.

11 50. A system for monitoring performance of an advanced  
12 process control system for at least one process output,  
13 comprising:

14 means for receiving process performance data for the at  
15 least one process output;

16 means for calculating at least one of a model health  
17 index, wherein the model health index indicates an estimate  
18 of an ability of a model to predict the behavior of the at  
19 least one process output as compared to an expected output,  
20 and a process health index, wherein the process health index  
21 indicates an estimated probability of violation by the at  
22 least one process output of predefined specification limits;  
23 and

1 means for indicating the results of the calculation  
2 based on the at least one of the model health index and the  
3 process health index.

4 51. A system for monitoring performance of an advanced  
5 process control system for at least one process output, the  
6 system comprising:

7 at least one tool, which measures the at least one  
8 process output; and

9 a controller, coupled to the at least one tool, which  
10 provides for central control of the at least one tool, the  
11 controller implementing instructions for controlling the at  
12 least one tool, the instructions comprising:

13 estimating a process deviation, wherein the  
14 process deviation indicates deviation of a process  
15 performance from at least one of a target process  
16 performance and a model of the process performance;

17 characterizing a current estimate of the process  
18 performance using at least one of a first index that  
19 represents the deviation of the process performance from the  
20 target process performance and a second index that  
21 represents the deviation of the model performance from a  
22 specified model performance; and

1 performing a notification function based on the  
2 value of at least one of the first index and the second  
3 index.

4 52. The system of claim 51, wherein the controller is  
5 a computer.

6 53. A system for monitoring performance of an advanced  
7 process control system for at least one process output, the  
8 system comprising:

9 at least one tool, which measures the at least one  
10 process output; and

11 a controller, coupled to the at least one tool, which  
12 provides for central control of the at least one tool, the  
13 controller implementing instructions for controlling the at  
14 least one tool, the instructions comprising:

15 receiving process performance data for the at  
16 least one process output;

17 comparing the process performance data to at least  
18 one of a predicted value for the process performance and a  
19 target value for the process performance;

20 calculating at least one parameter that reflects  
21 comparison of the process performance data to the at least  
22 one of the predicted value for the process performance and  
23 the target value for the process performance; and

1           indicating the results of the calculation based on  
2 the at least one parameter.

3           54. A system for monitoring performance of an advanced  
4 process control system for at least one process output, the  
5 system comprising:

6           at least one tool, which measures the at least one  
7 process output; and

8           a controller, coupled to the at least one tool, which  
9 provides for central control of the at least one tool, the  
10 controller implementing instructions for controlling the at  
11 least one tool, the instructions comprising:

12           receiving process performance data for the at  
13 least one process output;

14           calculating at least one of a model health index,  
15 wherein the model health index indicates an estimate of an  
16 ability of a model to predict the behavior of the at least  
17 one process output as compared to an expected output, and a  
18 process health index, wherein the process health index  
19 indicates an estimated probability of violation by the at  
20 least one process output of predefined specification limits;  
21 and

22           indicating the results of the calculation based on  
23 the at least one of the model health index and the process  
24 health index.

1        55. A system for monitoring performance of an advanced  
2 process control system for at least one process output, the  
3 system comprising:

4        at least one tool, which measures the at least one  
5 process output; and

6        a controller, coupled to the at least one tool, which  
7 provides for central control of the at least one tool, the  
8 controller implementing instructions for controlling the at  
9 least one tool, the instructions comprising:

10            calculating at least one of a variance of a  
11 prediction error for a processing performance of the at  
12 least one process output and a probability for violating  
13 specification limits of the processing performance of the at  
14 least one process output, wherein the at least one of the  
15 variance and the probability are based on an exponentially  
16 weighted moving average;

17            if the variance of the prediction error is  
18 calculated, calculating a model health index, wherein the  
19 model health index is a ratio of an exponentially weighted  
20 moving average-based estimate of a standard deviation of the  
21 prediction error to an expected estimate of the prediction  
22 error, and wherein the exponentially weighted moving  
23 average-based estimate of the standard deviation of the  
24 prediction error is derived from the variance of the  
25 prediction error;



1       if the probability for violating specification limits  
2   is calculated, calculating a process health index, wherein  
3   the process health index is a ratio of the probability for  
4   violating the specification limits to a specified  
5   probability limit; and

6       performing a notification function based on at  
7   least one of the model health index and the process health  
8   index.

9       56. A system for monitoring performance of an advanced  
10   process control system for at least one process output, the  
11   system comprising:

12       at least one tool, which measures the at least one  
13   process output; and

14       a controller, coupled to the at least one tool, which  
15   provides for central control of the at least one tool, the  
16   controller implementing instructions for controlling the at  
17   least one tool, the instructions comprising:

18       receiving process performance data for the at  
19   least one process output;

20       calculating at least one of a current model health  
21   index, wherein the current model health index indicates an  
22   estimate of an ability of a model to predict the behavior of  
23   a current one of the at least one process output as compared  
24   to an expected output, and a current process health index,

1 wherein the current process health index indicates an  
2 estimated probability of violation by a current one of the  
3 at least one process output of predefined specification  
4 limits;

5           if the current model health index is calculated,  
6 calculating a subsequent model health index, wherein the  
7 subsequent model health index indicates an estimate of an  
8 ability of a model to predict the behavior of a subsequent  
9 one of the at least one process output as compared to an  
10 expected output;

11           if the subsequent model health index is  
12 calculated, storing the current model health index and the  
13 subsequent model health index, such that comparing the  
14 current model health index and the subsequent model health  
15 index give an indication of a processing performance of the  
16 at least one process output;

17           if the current process health index is calculated,  
18 calculating a subsequent process health index, wherein the  
19 subsequent process health index indicates an estimated  
20 probability of violation by a subsequent one of the at least  
21 one process output of predefined specification limits; and

22           if the subsequent process health index is  
23 calculated, storing the current process health index and the  
24 subsequent process health index, such that comparing the  
25 current process health index and the current process health

1 index gives an indication of the processing performance of  
2 the at least one process output.

3 57. A system for monitoring performance of an advanced  
4 process control system for at least one process output, the  
5 system comprising:

6 at least one tool, which measures the at least one  
7 process output; and

8 a controller, coupled to the at least one tool, which  
9 provides for central control of the at least one tool, the  
10 controller implementing instructions for controlling the at  
11 least one tool, the instructions comprising:

12 calculating at least one of a current variance of  
13 a prediction error for a processing performance of the at  
14 least one process output and a current probability for  
15 violating specification limits of the processing performance  
16 the at least one process output, wherein the at least one of  
17 the current variance and the current probability are based  
18 on an exponentially weighted moving average;

19 if the current variance of the prediction error is  
20 calculated, calculating a current model health index,  
21 wherein the current model health index is a ratio of a  
22 current exponentially weighted moving average-based estimate  
23 of a standard deviation of the prediction error to an  
24 expected estimate of the prediction error, and wherein the  
25 current exponentially weighted moving average-based estimate

1 of the standard deviation of the prediction error is derived  
2 from the current variance of the prediction error;

3 if the current model health index is calculated,  
4 calculating a subsequent model health index, wherein the  
5 subsequent model health index is calculated in a  
6 substantially similar manner to the current model health  
7 index;

8 if the subsequent model health index is  
9 calculated, storing the current model health index and the  
10 subsequent model health index, such that comparing the  
11 current model health index and the subsequent model health  
12 index gives an indication of the processing performance of  
13 the at least one process output;

14 if the current probability for violating  
15 specification limits is calculated, calculating a current  
16 process health index, wherein the current process health  
17 index is a ratio of the probability for violating the  
18 specification limits to a probability limit;

19 if the current process health index is calculated,  
20 calculating a subsequent process health index, wherein the  
21 subsequent process health index is calculated in a  
22 substantially similar manner to the current process health  
23 index; and

24 if the subsequent process health index is  
25 calculated, storing the current process health index and the

1 subsequent process health index, such that comparing the  
2 current process health index and the subsequent process  
3 health index gives an indication of the processing  
4 performance of the at least one process output.

5 58. A system for monitoring performance of an advanced  
6 process control system for at least one process output, the  
7 system comprising:

8 at least one tool, which measures the at least one  
9 process output; and

10 a controller, coupled to the at least one tool, which  
11 provides for central control of the at least one tool, the  
12 controller implementing instructions for controlling the at  
13 least one tool, the instructions comprising:

14 calculating at least one of a first model health  
15 index of a process performance of a first one of the  
16 plurality of process outputs and a first process health  
17 index of the process performance of the first one of the  
18 plurality of process outputs;

19 calculating at least one of a second model health  
20 index of the process performance of a second one of the  
21 plurality of process outputs and a second process health  
22 index of the process performance of the second one of the  
23 plurality of process outputs;

1           if the first model health index and the second  
2 model health index are calculated, calculating an aggregate  
3 model health index of the process performance of the  
4 plurality of process outputs; and

5           if the first process health index and the second  
6 process health index are calculated, calculating an  
7 aggregate process health index of the process performance of  
8 the plurality of process outputs.

9           59. A computer-readable medium of instruction for  
10 monitoring performance of an advanced process control system  
11 for at least one process output, the instruction comprising:

12           receiving process performance data for the at least one  
13 process output;

14           comparing the process performance data to at least one  
15 of a predicted value for the process performance and a  
16 target value for the process performance;

17           calculating at least one parameter that reflects  
18 comparison of the process performance data to the at least  
19 one of the predicted value for the process performance and  
20 the target value for the process performance; and

21           indicating the results of the calculation based on the  
22 at least one parameter.

1           60. A computer-readable medium of instruction for  
2 monitoring performance of an advanced process control system  
3 for at least one process output, the instruction comprising:

4           receiving process performance data for the at least one  
5 process output;

6           calculating at least one of a model health index,  
7 wherein the model health index indicates an estimate of an  
8 ability of a model to predict the behavior of the at least  
9 one process output as compared to an expected output, and a  
10 process health index, wherein the process health index  
11 indicates an estimated probability of violation by the at  
12 least one process output of predefined specification limits;  
13 and

14           indicating the results of the calculation based on the  
15 at least one of the model health index and the process  
16 health index.

17           61. A computer-readable medium of instruction for  
18 monitoring performance of an advanced process control system  
19 for at least one process output, the instruction comprising:

20           calculating at least one of a variance of a prediction  
21 error for a processing performance of the at least one  
22 process output and a probability for violating specification  
23 limits of the processing performance of the at least one  
24 process output, wherein the at least one of the variance and

1 the probability are based on an exponentially weighted  
2 moving average;

3 if the variance of the prediction error is calculated,  
4 calculating a model health index, wherein the model health  
5 index is a ratio of an exponentially weighted moving  
6 average-based estimate of a standard deviation of the  
7 prediction error to an expected estimate of the prediction  
8 error, and wherein the exponentially weighted moving  
9 average-based estimate of the standard deviation of the  
10 prediction error is derived from the variance of the  
11 prediction error;

12 if the probability for violating specification limits  
13 is calculated, calculating a process health index, wherein  
14 the process health index is a ratio of the probability for  
15 violating the specification limits to a specified  
16 probability limit; and

17 indicating the results of the calculation based on at  
18 least one of the model health index and the process health  
19 index.

20 62. A computer-readable medium of instruction for  
21 monitoring performance of an advanced process control system  
22 for at least one process output, the instruction comprising:

23 63. A computer-readable medium of instruction for  
24 monitoring performance of an advanced process control system  
25 for at least one process output, the instruction comprising:



1       receiving process performance data for the at least one  
2 process output;

3       calculating at least one of a current model health  
4 index, wherein the current model health index indicates an  
5 estimate of an ability of a model to predict the behavior of  
6 a current one of the at least one process output as compared  
7 to an expected output, and a current process health index,  
8 wherein the current process health index indicates an  
9 estimated probability of violation by a current one of the  
10 at least one process output of predefined specification  
11 limits;

12       if the current model health index is calculated,  
13 calculating a subsequent model health index, wherein the  
14 subsequent model health index indicates an estimate of an  
15 ability of a model to predict the behavior of a subsequent  
16 one of the at least one process output as compared to an  
17 expected output;

18       if the subsequent model health index is calculated,  
19 storing the current model health index and the subsequent  
20 model health index, such that comparing the current model  
21 health index and the subsequent model health index give an  
22 indication of a processing performance of the at least one  
23 process output;

24       if the current process health index is calculated,  
25 calculating a subsequent process health index, wherein the

1 subsequent process health index indicates an estimated  
2 probability of violation by a subsequent one of the at least  
3 one process output of predefined specification limits; and

4 if the subsequent process health index is calculated,  
5 storing the current process health index and the subsequent  
6 process health index, such that comparing the current  
7 process health index and the current process health index  
8 gives an indication of the processing performance of the at  
9 least one process output.

10 64. A computer-readable medium of instructions for  
11 monitoring performance of an advanced process control system  
12 for at least one process output, the instructions  
13 comprising:

14 calculating at least one of a current variance of a  
15 prediction error for a processing performance of the at  
16 least one process output and a current probability for  
17 violating specification limits of the processing performance  
18 the at least one process output, wherein the at least one of  
19 the current variance and the current probability are based  
20 on an exponentially weighted moving average;

21 if the current variance of the prediction error is  
22 calculated, calculating a current model health index,  
23 wherein the current model health index is a ratio of a  
24 current exponentially weighted moving average-based estimate  
25 of a standard deviation of the prediction error to an

1 expected estimate of the prediction error, and wherein the  
2 current exponentially weighted moving average-based estimate  
3 of the standard deviation of the prediction error is derived  
4 from the current variance of the prediction error;

5 if the current model health index is calculated,  
6 calculating a subsequent model health index, wherein the  
7 subsequent model health index is calculated in a  
8 substantially similar manner to the current model health  
9 index;

10 if the subsequent model health index is calculated,  
11 storing the current model health index and the subsequent  
12 model health index, such that comparing the current model  
13 health index and the subsequent model health index gives an  
14 indication of the processing performance of the at least one  
15 process output;

16 if the current probability for violating specification  
17 limits is calculated, calculating a current process health  
18 index, wherein the current process health index is a ratio  
19 of the probability for violating the specification limits to  
20 a probability limit;

21 if the current process health index is calculated,  
22 calculating a subsequent process health index, wherein the  
23 subsequent process health index is calculated in a  
24 substantially similar manner to the current process health  
25 index; and

1       if the subsequent process health index is calculated,  
2       storing the current process health index and the subsequent  
3       process health index, such that comparing the current  
4       process health index and the subsequent process health index  
5       gives an indication of the processing performance of the at  
6       least one process output.

7       65. A computer-readable medium of instructions for  
8       monitoring performance of an advanced process control system  
9       for at least one process output, the instructions  
10      comprising:

11       calculating at least one of a first model health index  
12      of a process performance of a first one of the plurality of  
13      process outputs and a first process health index of the  
14      process performance of the first one of the plurality of  
15      process outputs;

16       calculating at least one of a second model health index  
17      of the process performance of a second one of the plurality  
18      of process outputs and a second process health index of the  
19      process performance of the second one of the plurality of  
20      process outputs;

21       if the first model health index and the second model  
22      health index are calculated, calculating an aggregate model  
23      health index of the process performance of the plurality of  
24      process outputs; and

1           if the first process health index and the second  
2 process health index are calculated, calculating an  
3 aggregate process health index of the process performance of  
4 the plurality of process outputs.

5           66. A computer-readable medium of instructions for  
6 monitoring performance of an advanced process control system  
7 for at least one process output, the instructions  
8 comprising:

9           estimating a process deviation, wherein the process  
10 deviation indicates deviation of a process performance from  
11 at least one of a target process performance and a model of  
12 the process performance;

13           characterizing a current estimate of the process  
14 performance using at least one of a first index that  
15 represents the deviation of the process performance from the  
16 target process performance and a second index that  
17 represents the deviation of the model performance from a  
18 specified model performance; and

19           performing a notification function based on the value  
20 of at least one of the first index and the second index